Barrow: Theories of Everything

Preface.

p.vii Einstein fumbles, isolated quest for TOE

But now in mainstream of theoretical physics

Gifford lectures 1988. elaborated

ch1 Ultimate Explanations:

p.1 We know neither the questions nor the answers?

p.2 Everything? — what does it include — Shakespeare, Taj Mahal, Mona Lisa

simple metatheories, but maybe infinite no of refinements ~~to~~ needed

p.3 Prussian Patent office closed down end 19th C — nothing left to invest — Einstein in patent office at Zurich in 1908..

p.4 Ingredients:
- Laws
- initial conditions
- identity forces/particle
- constants
- broken symmetry
- organization principles
- selection biases
- categories of thought

Eightfold way.

Physics has meaning: candidates for insignificance!

p.5 Whitehead's doubt

p.6 economy, unification

p.9 Platonist v. Realist internalizes v externally the World.

p.11 algorithmic compression.

ch2 Laws p.13. Eastern Islam — no analysis

p.14 Pauli : Man shall not join what God has torn asunder
p.15 → Eddington & Einstein.

p.16 Universe is necessary or contingent?

p.20 Creation from nothing — zero total mass-energy

p.22 strings.
p.27 Emmanuel.

ch3 Natural Constants   p.23 a priori : [illegible] Coleman.

p.38 Mathematics of universe may be complete?

p.42 no boundary in formula of initial conditions

p.60 Hawking — no boundary Universe
p.67
p.68 wave function of the Universe.

ch.4 Forces & Particles

p.74 gauge principles
→ dictate forces

p.80 Kelvin vortex theory of atoms — use of topology.

p.85 standard model.

ch 5 Constants of Nature

p.94 graph mass v size of all objects in Universe.

p.95 Coincidences reasons for evolution of constants

p.96 Multiple bubble universe

p.97 Prob (Λ) distribution

p.112 cf. durations of constants in 'isolated' universe
CR anthropically selected) not most probable.

ch6 Broken Symmetries

p.125 importance of linearity – method of analysis works
not true of non-linear systems

p.133 describes inflationary Universe.
randomness prevents particulars of our Universe from being predicted

ch7 Organizing Principles

p.137 Fig. showing mass – size plot of organized structures
Our brains are most complicated objects we have encountered in the Universe

p.138/139 importance of 'condensed-state' physics, reveals organizational principles.

p.140 Vitalism supposed complex systems could not be [illegible] so different from smaller systems – this is just not true.

p.143 Fig. showing evolutionary pathways.

p.145 Fig. shows development of computer power.
Human brain surpassed by supercomputers!

p.148 Fig. showing power & information storage capacity of living organisms & human technological artefacts

p.151 Universe & randomness important in particle physics but for macro-world complexity, organization, time & change are the vital ingredients.

p.188 The arrows of time

Ch 8 Selection Effects

p.168 Fig. showing chaotic inflationary Universe

p.178 Local observations may not be at all representative of overall global structure.

Ch 9 Is 'pi' really in the sky?

p.173 Is brain adapted to understand universe? Evolution has over-endowed us with the capacity to understand the Universe
Success of mathematics + ability to create successful mathematics ??=

p.179 Pre-established harmony between the mind & the world

p.181 ff: What is mathematics – formalism, inventionism, platonic, constructivism

p.188 ff. 'Symbiosis' of mathematical structures & physical ideas, conics, non-Eucl. geom, tensors, groups, matrices, Hilbert space,

p.191 move back from Bourbaki approach in Maths.

p.194 Locality, Bell theorem,

p.195 Us are all particles alike (cf Leibniz) – if not (a world of footballs?) it would be unintelligible the

p.200 Science depends on dynamic coherence of the world in different contexts – cf chaotic processes which are not catastrophic

p. 201 Secret of nature:
Compression of all knowledge.
or largest amount of knowledge
(cf indeterminism in QM)

p. 203 Is Universe a computer
Laws of Nature, dynamics [illegible]
reasons. discrete computation

p. 206 the unknowable – emotions, judgements,
morals, art.
cf Jowett, 'what he doesn't know isn't
knowledge'.

p. 209 Perspective features of world
– neither testable nor computable.